Saskatchewan
Agriculture

Agriculture Development Fund

Technical/Final Report
to
Saskatchewan Agriculture Development Fund

A Study of Potential Potato Starch Yields Under Commercial Conditions in Saskatchewan

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SASKATCHEWAN AGRICULTURE
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FINAL REPORT ON STARCH TRIALS SUBMITTED TO E.R.D.A.

INTRODUCTION

Investigation with industrial potato cultivars for starch production potential was continued in 1985. The potential use of potato starch produced domestically is for the potash mining industry to replace imported guar gum and other products. A domestic source is dependent upon several factors. Feasibility of crop production is one. Other considerations include the manufacture of this starch and its adaptability to the present refining process. Industrial starch potatoes are considered a new crop, as production for starch is separate from table stock or processing potatoes, but before this new potential becomes a reality, cultural techniques and cultivar performance tests are mandatory.

In 1984, eight cultivars were tested at two commercial grower sites. These plots were maintained by the growers. The Department of Horticulture Science conducted yield tests and analyzed data from both sites. The results for starch content showed a significant difference among cultivars at both sites. It was also determined that there was a high degree of cultivar - site interaction. The cultivar yield was not determined at one site due to an early frost. At the second site, grower yields from the final harvest did not correlate with sample yields because of different harvest methods.

In 1985, yield performance trials were continued on the six highest yielding cultivars from the 1984 trials. These trials were conducted at two sites, Saskatoon and Outlook. This was the first year plots were grown at Saskatoon. At Outlook a commercial producer planted a block of the cultivars which were maintained as a commercial planting. At Saskatoon, a replicated research plot was planted and maintained by the Department of Horticulture Science.

This year, a further test was conducted to determine changes in starch deposition as tubers matured. Samples were harvested from 20 August to 11 October, every 10 days. Establishing the starch deposition pattern is important to determine critical harvest dates.

Five samples were taken by the department at each site. The first four harvests involved sampling replicated two hill plots for each cultivar. On the last date, a final harvest was conducted where replicated ten meter plots were harvested for each cultivar. Yield data were collected from the last harvest date. The tubers from each sample for each date were graded into small (<55 mm diameter), marketable (>55 mm diameter) and large (>88 mm diameter) size units. Specific gravity tests were taken for each sample.

RESULTS

Specific gravity: At Saskatoon, there was no significance for variation for cultivars (Table One). For the Outlook site, there was a significant difference between cultivars for each size category (Table Two). The variation in specific gravity between the two sites is significant (Table Three). Raritan had the highest specific gravity for marketable sized tubers at both sites.

Percentage starch: The percent starch for marketable sized tubers was calculated from the specific gravity. This information is presented for each cultivar in Figures One to Six. The starch deposition pattern followed a similar trend. An increase in starch content occurred between mid-August and mid-September. The percent starch does not vary significantly (standard error of mean) after September 12. A slight decrease in starch content occurred in some cultivars (Arran Consul: Figure 4 and

Grand Falls: Figure 5). This decrease might be attributable to chilling injury. The crop suffered frost damage at Outlook prior to the October 1 harvest. The Saskatoon plots were frozen before the October 11 harvest.

The percentage of starch for all cultivars was lower for the Outlook site than the Saskatoon site. The Saskatoon plots were planted three weeks earlier than the Outlook plots, which probably explains the difference in starch content between the two sites.

Yield: Table Four summarizes the percentage starch, the sample plot yields and the projected yields of starch per hectare for the two sites. For all cultivars , with the exception of Raritan, yields at Saskatoon were higher. This difference may not be significant as field losses at Outlook were greater due to more severe frost damage. There was no difference in cultivar yields at Saskatoon, but there was a cultivar difference at Outlook. Raritan yielded much higher and Russet Burbank was the poorest yielder. When the yield data is used to project kilograms of starch per hectare, Raritan showed the most promise as a high starch yielding potato. This is consistent with previous years findings. The cultivars Arran Consul, Mirton Pearl and Grand Falls were quite similar in starch yield at both sites. It must be noted that as a result of the frost, final plot sampling was carried out with difficulty. There was enough material to calculate specific gravities and starch content. However, at the commercial site, final acreage yields could not be carried out due to the poor fall weather and eventual freeze-up.

SUMMARY

The initial starch deposition patterns which were established plateaued at about the same date, September 12, at both Saskatoon and

Outlook. Starch yields increased significantly from August 20 to September 12 when the yields levelled off. There was no significant difference between harvest dates for starch content after September 12. The same pattern was present at both Saskatoon and Outlook for most cultivars. This would suggest that growers must wait until September 12, but after that date there was no advantage in delaying harvest date. The maximum level of starch content was determined for each cultivar and can be used as a guideline for future commercial harvests for potato starch.

The overall lower level of starch at Outlook was probably due to the later planting date (3 weeks). It is interesting that in most cases the depressed starch content was not compensated for by later harvests. Therefore, the late harvest date either imposed a non-compensatable penalty or starch deposition is controlled by daylength, which would again suggest early planting is critical to achieve maximum yields. This trial should be repeated for at least two more years to confirm the results and to determine the extent of cultivar x environment interaction.

Statistical analyses of the data taken in 1985 had a very low coefficient of variation indicating a low level of uncontrolled variation, thus the data should be very reliable.

At this point in the tests, Raritan has the best potential to produce the highest yields of starch at Outlook.

TABLE ONE: SPECIFIC GRAVITIES AT SASKATOON

	Mean	
	Small	Marketable
Russet Burbank	1.075	1.080
Cherokee	1.079	1.077
Arran Consul	1.078	1.077
Mirton Pearl	1.079	1.080
Raritan	1.077	1.084
Grand Falls	1.073	1.081
	ns	ns

TABLE TWO: SPECIFIC GRAVITIES AT OUTLOOK

	Mean		
	Marketable	Oversize	Small
Russet Burbank	1.068	1.071	1.076
Cherokee	1.065	1.068	1.073
Arran Consul	1.066	1.071	1.060
Mirton Pearl	1.069	1.070	1.074
Raritan	1.081	1.083	1.087
Grand Falls	1.063	1.068	1.063
LSD 5%	.003*	-.001*	.005*

* Significant variations among cultivars for each size at 5% level.

TABLE THREE: SPECIFIC GRAVITIES AT SASKATOON AND OUTLOOK

	Small		Marketable	
	Barrich	Saskatoon	Barrich	Saskatoon
Russet Burbank	1.068	1.075	1.071	1.080
Cherokee	1.065	1.079	1.068	1.077
Arran Consul	1.066	1.078	1.071	1.077
Mirton Pearl	1.069	1.079	1.070	1.080
Raritan	1.081	1.077	1.083	1.084
Grand Falls	1.063	1.073	1.068	1.081
	*	*	*	*

There is a significant difference in the specific gravities between the two sites.

* Significant variations for specific gravity between Saskatoon and Outlook for each size category, 5% level.

TABLE FOUR: PERCENT STARCH, YIELD, AND KG STARCH/HECTARE FOR SIX CULTIVARS

	% Starch		Yield (kg/10 m^2)		Kg Starch/Hectare	
	Saskatoon	Barrich	Saskatoon	Barrich	Saskatoon	Barrich
Russet Burbank	14.76	13.37	35.1	21.0	5,180	2,800
Cherokee	12.77	12.57	35.2	25.5	4,500	3,200
Arran Consul	13.57	13.76	34.0	32.5	4,610	4,466
Mirton Pearl	13.57	12.97	34.8	34.5	4,720	4,466
Raritan	14.96	15.63	33.4	36.3	4,990	5,583
Grand Falls	14.61	12.97	30.2	30.5	4,220	3,950

FIGURE ONE: PERCENT STARCH ON FIVE HARVEST DATES FOR RUSSET BURBANK

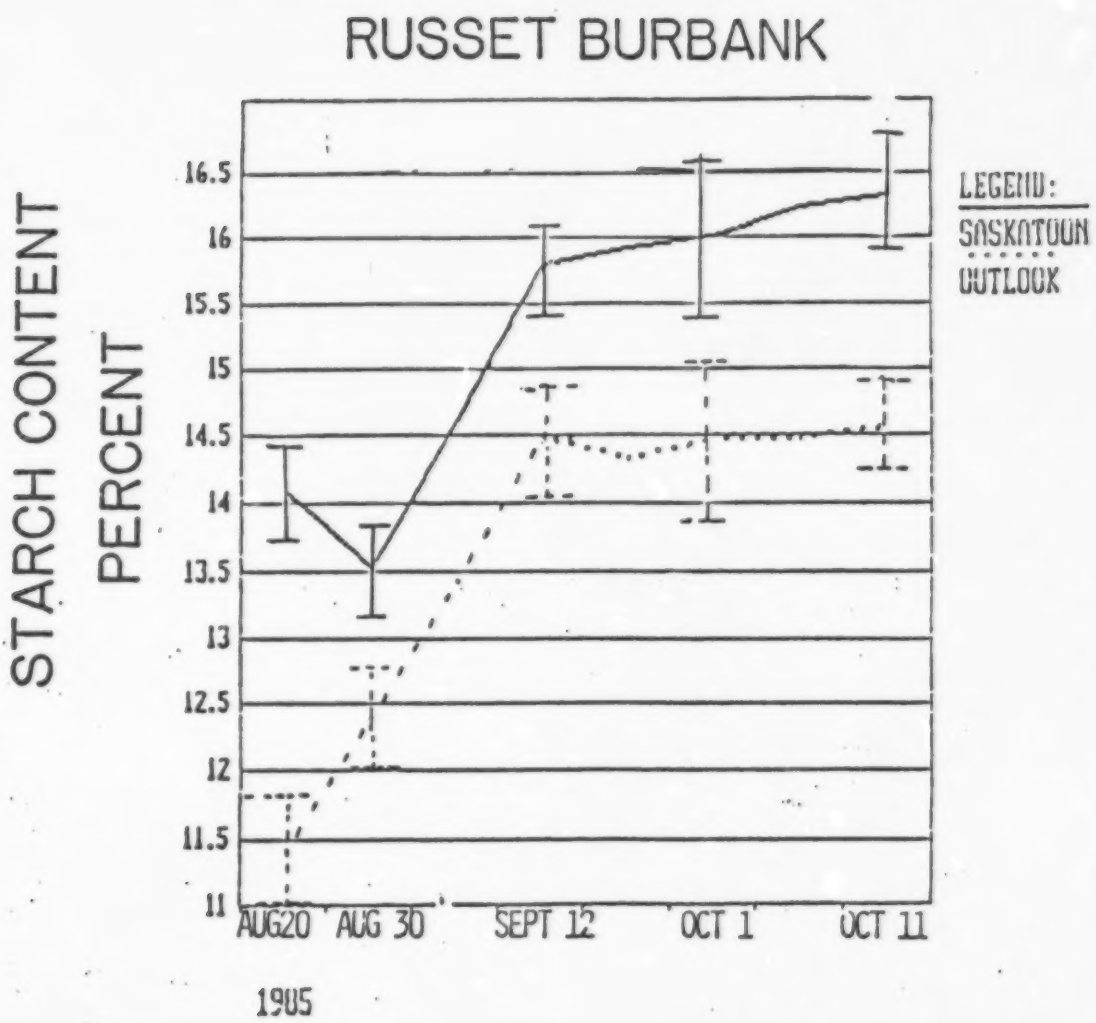
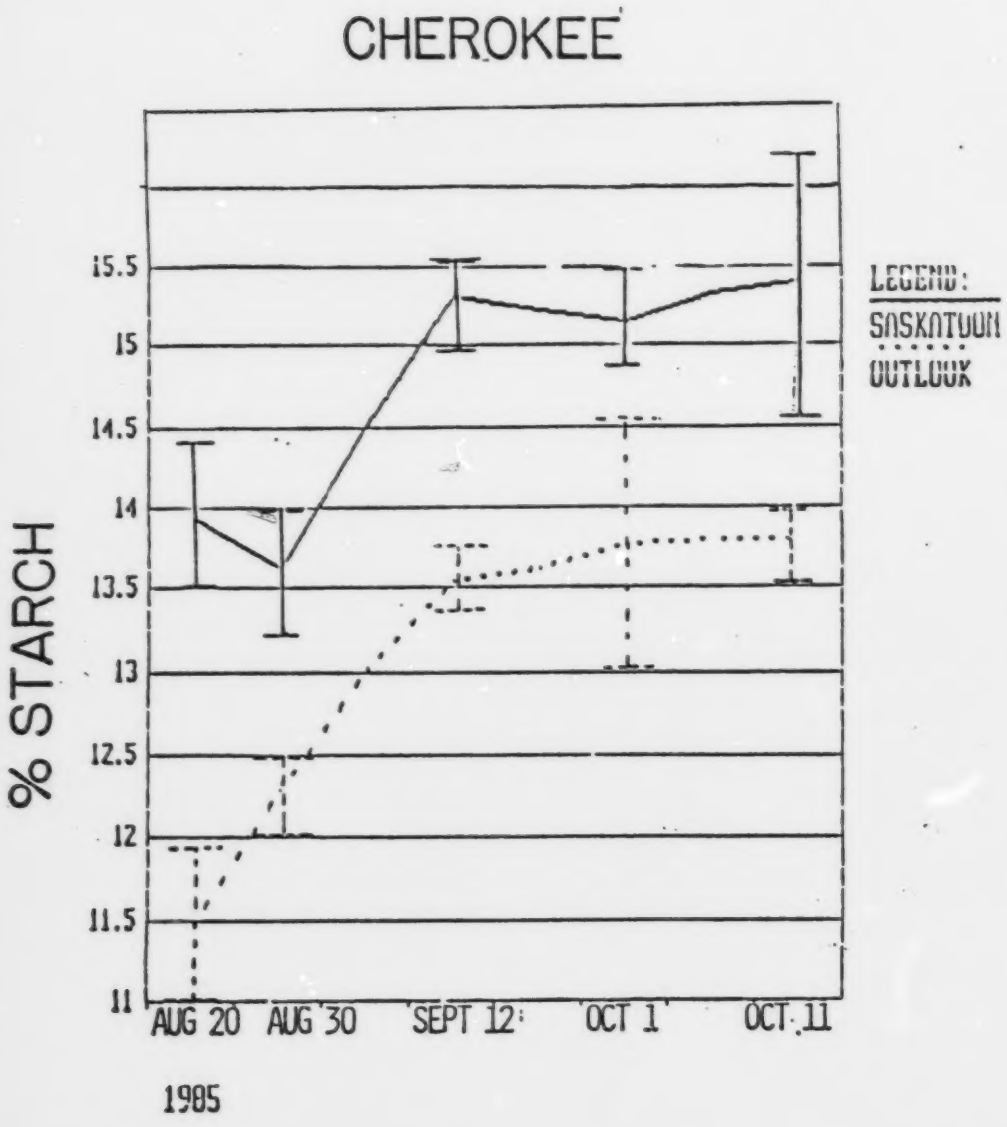
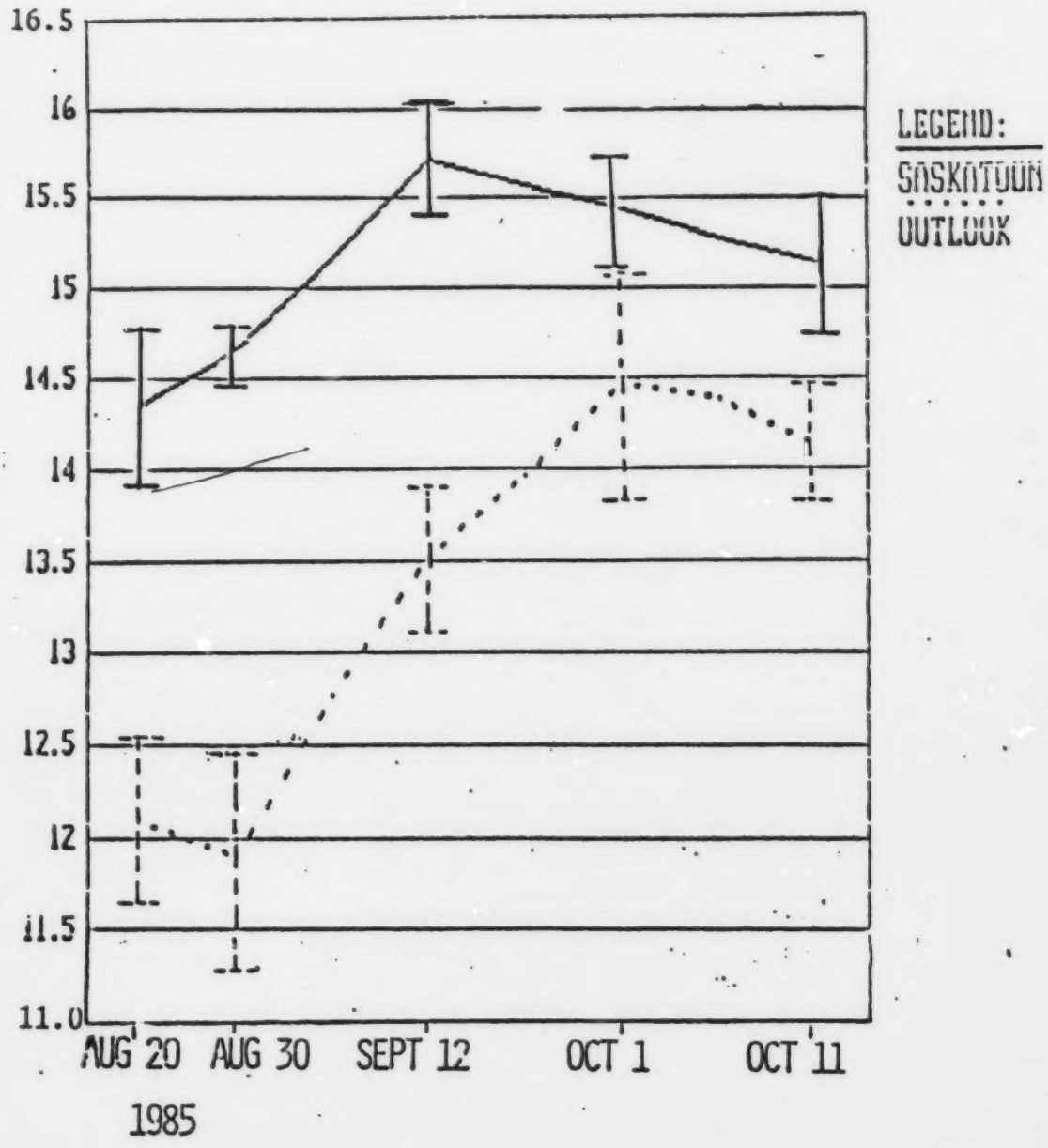


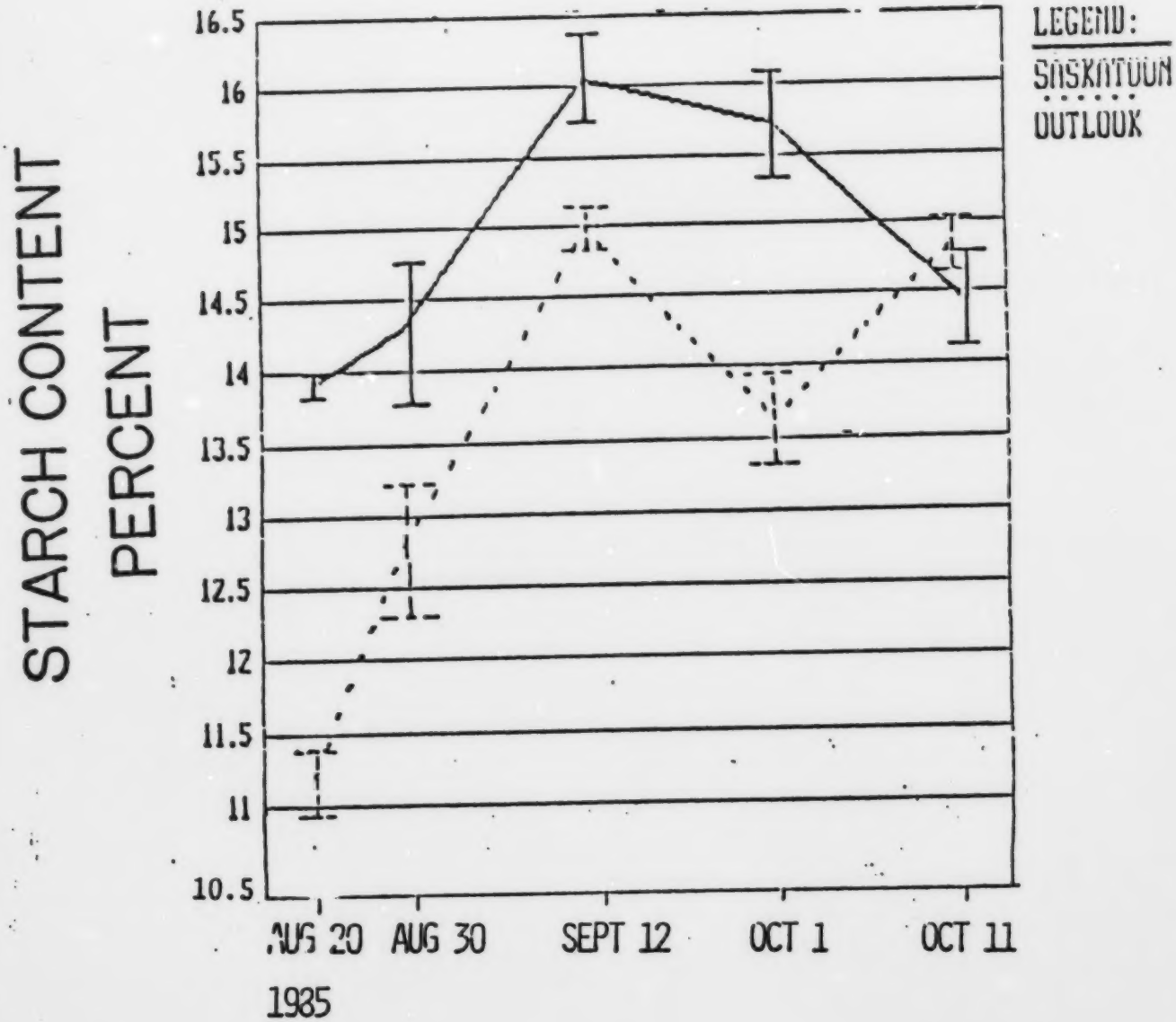
FIGURE TWO: PERCENT ST. .CH ON FIVE HARVEST DATES FOR CH. .KEE



MIRTON PEARL



ARRAN CONSUL



GRAND FALLS

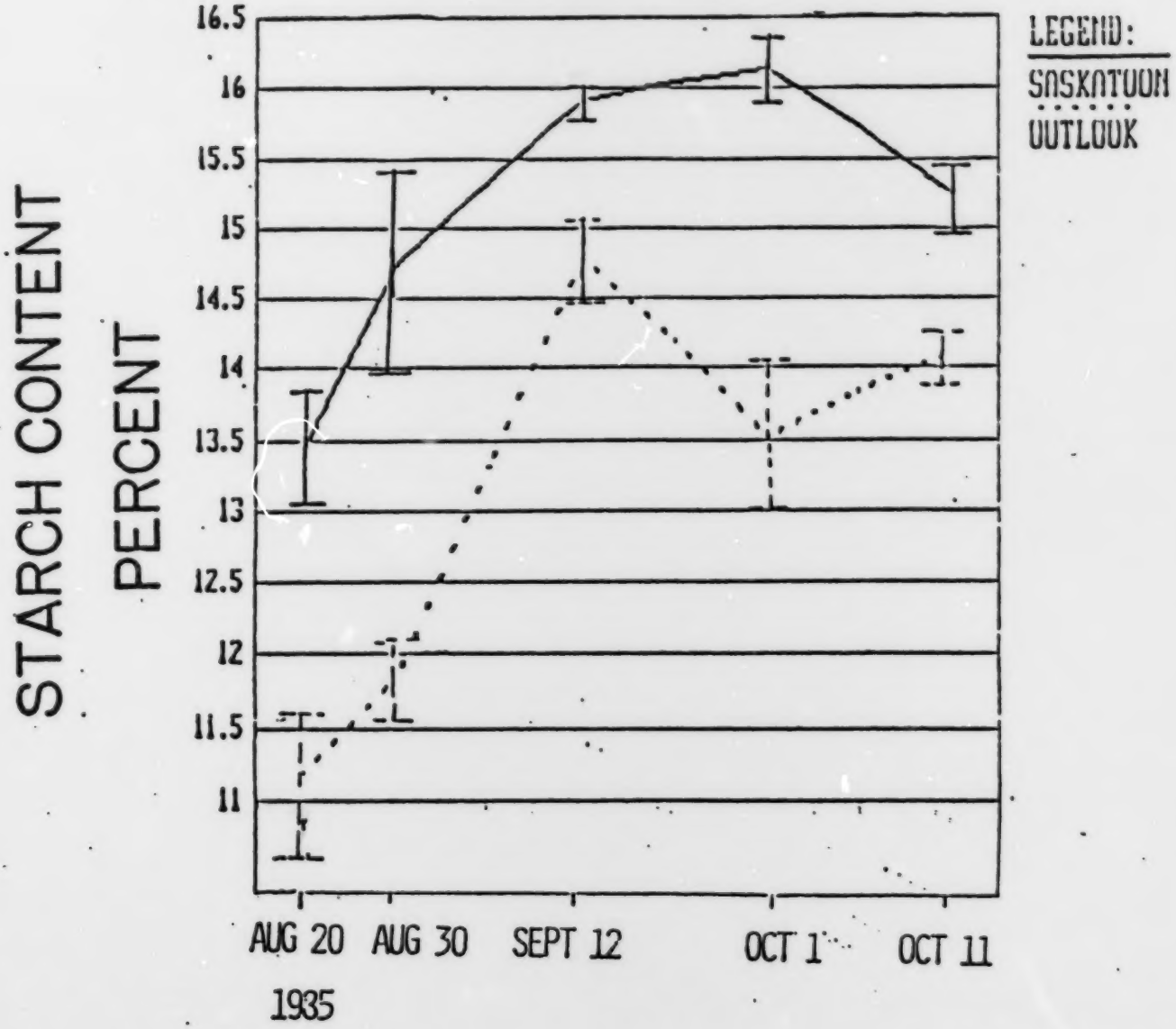
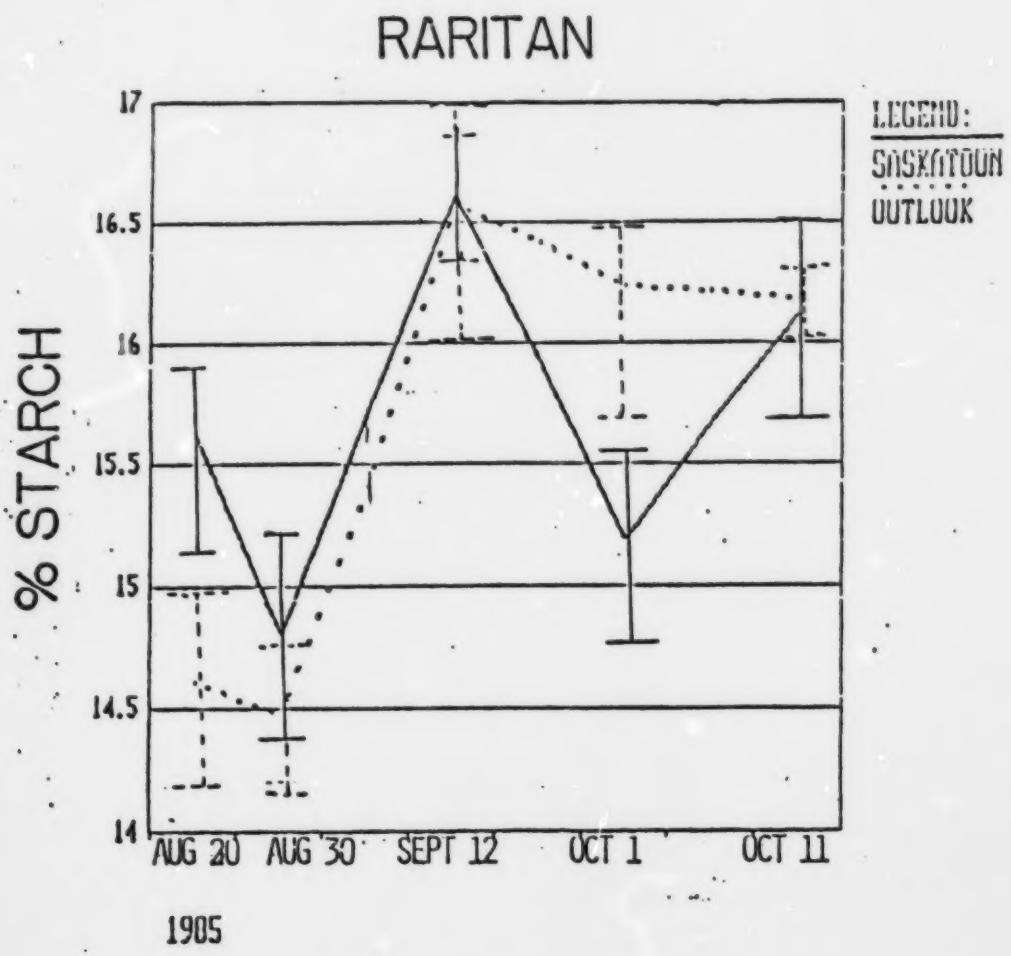

STARCH CONTENT
PERCENT
16.5
16
15.5
15
14.5
14
13.5
13
12.5
12
11.5
11
AUG 20
AUG 30
SEPT 12
OCT 1
OCT 11
1935
LEGEND:
SASKATOON
OUTLOOK

FIGURE SIX: PERCENT S. .RCH FOR FIVE HARVEST DATES FOR :ITAN



STARCH TRIAL EXPENSE REPORT

DEPARTMENT OF HORTICULTURE

WAGES		
Harvest:		
Field Laborer	144 hours x $ 9.14	1462.40
Gardener	64 hours x $10.54	780.46
Lab Tests:		
	220 hours x $ 9.14	2010.80
Report Preparation		
	50 hours x $ 9.60	480.00
Clerical		300.00
Project Supervision		
	4 days @ $250	1000.00
FIELD PRODUCTION		
irrigation, power, labor		600.00
materials		300.00
TRANSPORTATION		
	1320 km. @ .18¢	237.60
MEALS		
	22 meals @ $7.00	154.00
		$7325.26